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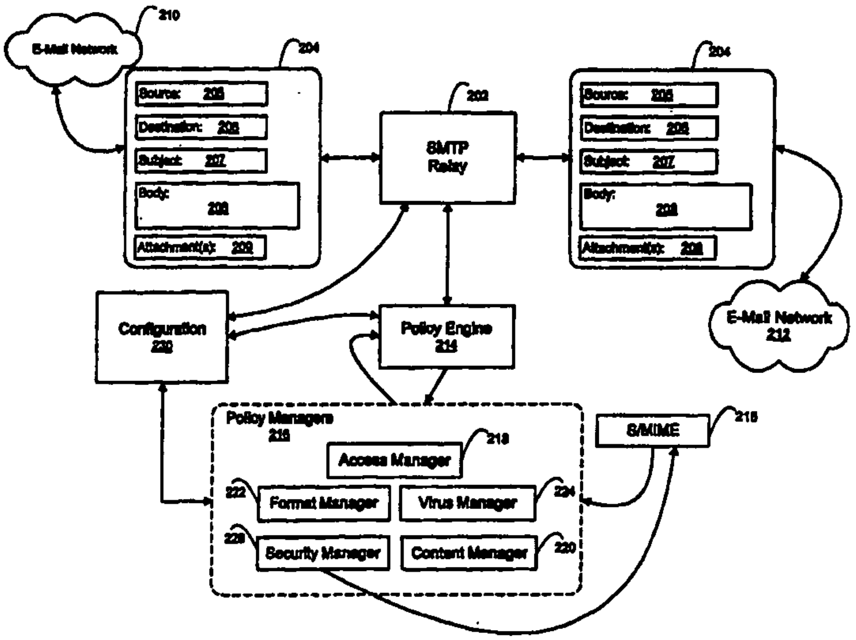
(54) Title: E-MAIL FIREWALL WITH STORED KEY ENCRYPTION/DECRYPTION

(57) Abstract

An e-mail firewall (105) applies policies to e-mail messages (204) between a first site and a plurality of second sites in accordance with a plurality of administrator selectable policies (216). The firewall comprises a simple mail transfer protocol (SMTP) relay (202) for causing the e-mail messages (204) to be transmitted between the first site and selected ones of the second sites. A plurality of policy managers (216) enforce administrator selectable policies. The policies, such as encryption and decryption policies, comprise at least a first source/destination policy (218), at least a first content policy (220) and at least a first virus policy (224). The policies are characterized by a plurality of administrator selectable criteria (310), a plurality of administrator selectable exceptions (312) to the criteria and a plurality of administrator selectable actions (314, 316, 322) associated with the criteria and exceptions. The policy managers comprise an access manager (218) for restricting transmission of e-mail messages (204) between the first site and the second sites in accordance with the source/destination policy (218). The policy managers (216) further comprise a content manager (220) for restricting transmission of e-mail messages (204) between the first site and the second sites in accordance with the content policy (220), and a virus manager (224) for restriction transmission of e-mail messages (204) between the first site and the second sites in accordance with the virus policy (224).



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E-MAIL FIREWALL WITH STORED KEY ENCRYPTION/DECRYPTION

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RELATED APPLICATIONS

This application claims priority to U.S. Provisional Patent Application 60/053,668 filed on July 24, 1997.

BACKGROUND OF THE INVENTION

TECHNICAL FIELD

This application pertains generally to the field of computer security and more specifically to security for electronic mail systems.

BACKGROUND ART

The widespread use of electronic mail (e-mail) and groupware applications coupled with the growth and ubiquity of the Internet have opened new avenues for business level communications and electronic commerce. Organizations are increasingly relying on e-mail for the transfer of critical files such as purchase orders, sales forecasts, financial information and contracts both within the organization and increasingly with other organizations via the Internet. In this setting, these files are now tangible information assets that must be protected.

A number of conventional security measures exist to insure the confidentiality and integrity of modern data communications. For example, traditional firewalls prevent network access by unauthorized users. Secure sockets technology allows for data to be passed securely over the World Wide Web (WWW). E-mail, however, which is by far the most prominent application over the Internet, still remains problematic, from a security standpoint, for most organizations. Many traditional firewalls simply limit access to information protected by the firewall but do not contain the capability to limit transfer of information, into or out of an organization, by way of e-mail. This can lead to inadvertent or deliberate disclosure of confidential information from e-mail originating within an organization and introduction of viruses from e-mail entering an organization.

One solution to protecting confidentiality of e-mail messages is by encrypting such messages. Further security is available by way of digital signatures, which provide for authentication of e-mail messages. Encryption and authentication are both supported in the S/MIME (Secure/Multipurpose Internet Mail Extensions) messaging protocol defined in documents generated by the Internet Engineering Task Force (IETF) entitled "S/MIME Message Specification" (1997) and "S/MIME Certificate Handling"(1997). Individual users can encrypt/decrypt and authenticate e-mail messages using commercially available software. However, the use of software to perform such tasks is not always simple and therefore can detract from the inherent ease of use of e-mail as a means of communication. Moreover, an organization wishing to use such software must rely on individual users to encrypt all necessary messages without means of any centralized control. In addition, many conventional firewalls contain no capability to control the content or format of certain messages that enter or exit an organization. For example, many conventional firewalls contain no capability to ensure that e-mail meeting certain criteria such as content or source and/or destination address or domains, is encrypted. In addition, many conventional firewalls contain no capability to control unwanted messages entering an organization such as unsolicited e-mail advertising.

There is accordingly a need for an e-mail firewall that provides improved centralized control over e-mail messages exiting and entering an organization.

SUMMARY OF THE INVENTION

In a principal aspect, the present invention provides an e-mail firewall (105) for screening e-mail messages (204) originating in, or entering into a computer network (101, 103). Embodiments employing the principles of the present invention advantageously take the form of an e-mail control system (105) that controls e-mail messages (204) transmitted from and received by a computing site. The e-mail control system (105) includes a message encryptor (526) which encrypts, in accordance with at least a first stored encryption key (528), a first designated type of message (204) transmitted from the computing site. A message decryptor (552) decrypts, in accordance with at least a second stored encryption key (528), a second designated type of message (204) received by the computing site. A filter (216) monitors messages (204), after decryption by the decryptor (552) and before encryption by the encryptor (526), in accordance with changeable filter information (216).

A significant advantage of such embodiments is increased centralized control of e-mail policies by an organization. All e-mail messages entering into or originating within an organization can be encrypted or decrypted and filtered in accordance with policies imposed by the organization. Individual users of desktop computers within the organization therefore need not be concerned with ensuring that they comply with e-mail policies of the organization. E-mail messages can be monitored for certain content, or for certain sources or destinations.

Advantageously, embodiments employing the principles of the present invention operate transparently to individual users within an organization. For example such individual users need not be concerned with complying with encryption policies of the organization. E-mail messages containing certain content, or originating from, or being transmitted to specified addresses or domains, can be automatically encrypted and/or filtered. For example, if an organization (e.g. Company A) which frequently exchanges e-mail with another organization (e.g. Company B) determines that all e-mail to Company B should be encrypted for security purposes, then an e-mail firewall in Company A, as described above, can be configured to recognize the domain name of Company B and to store an encryption key. Thereafter, all e-mail messages from Company A to Company B will be encrypted by the above described e-mail firewall without requiring any additional action by individual users. If Company B has installed an e-mail firewall employing the above described principles than that e-mail firewall can be configured to decrypt messages from Company A. Individual recipients in Company B of e-mail from Company A therefore need not take any additional action to decrypt e-mail from Company A. All e-mail messages from Company A to Company B can therefore be securely exchanged with no intervention from users at Company A or Company B. Of course, the e-mail firewall of Company B can be configured to allow similar transmission of e-mail messages from Company B to Company A.

In addition, other policies can be enforced with respect to transmission of messages between Company A and B. For example, inadvertent (or even deliberate) disclosure of certain information between Companies A and B can be reduced by configuring the above described filter of the e-mail firewall in question with rules to recognize and prevent transmission of e-mail messages containing certain terms or phrases. The e-mail firewall may also be configured with exceptions to such rules. For example, e-mail from or to certain users may be exempted from such rules. Also, actions taken by the e-mail firewall after a message is prevented from being transmitted are changeable. For example, the message in question may be returned to the sender with an explanatory message. Alternatively, or in addition, the message may be stored for viewing by an administrator, or the messages may be deleted. Multiple encryption keys, each associated with one or more domains or individual addresses, may be stored in e-mail firewalls employing the aforesaid principles to allow secure communications with multiple domains and/or individual users.

These and other advantages may be better understood by reference to the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 of the drawings is a block diagram showing a plurality of e-mail networks which are coupled by way of the Internet and which employ an e-mail firewall employing the principles of the present invention.

Figure 2 of the drawings is a block diagram of a preferred embodiment of an e-mail firewall.

Figures 3 and 4 are block diagrams illustrating further details of operation of the e-mail firewall of Figure 2.

Figures 5(a), 5(b) and 5(c) are block diagrams illustrating alternative secure e-mail communication mechanisms.

Figures 6(a) and 6(b) are flowcharts illustrating operation of a preferred embodiment of an e-mail firewall.

Figure 7 is a block diagram showing further details of a portion of Figures 6(a) and 6(b).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In Figure 1 of the drawings, e-mail networks 101 and 102 are coupled to e-mail network 103 by way of a Wide Area Network (WAN) 104 such as the Internet. Disposed between the Internet 104 and e-mail network 101and 103 are an access firewall 106 and an e-mail firewall 105. E-mail network 102 is coupled to Internet 104 only by access firewall 106.1. E-mail networks 101, 102 and 103 may each take a conventional form. For example, e-mail networks 101 - 103 may take the form of a Local Area Network (LAN) or a plurality of LANs which support one or more conventional e-mail messaging protocols. Access firewalls 106 may also take a conventional form. Access firewalls 106 operate to limit access to files stored within a computer network, such as e-mail networks 101 - 103, from remotely located machines. E-mail firewalls 105 (individually shown as 105.1 and 105.2) advantageously take a form as described in further detail herein to control transmission of electronic mail messages between an internal site and one or more external sites. An internal site for e-mail firewall 105.2, by way of example, may take the form of e-mail network 103. External sites for e-mail firewall 105.2 are any sites not contained in e-mail network 103. For example, external sites for e-mail firewall 105.2 are any sites in e-mail networks 101 and 102 as well as any other sites coupled to Internet 104. E-mail firewall 105 is preferably positioned on the "safe-side" of the access firewall 106. Figure 1 should be understood as showing, by way of an example, the principles of the embodiments described herein. The access firewalls 106 are shown only for purposes of explanation and are not required for operation of embodiments employing the principles of the present invention.

Preferably the e-mail firewall 105 takes the form of a program executing on a conventional general purpose computer. In an exemplary embodiment, the computer executes the Windows NT operating system available from Microsoft Corp., Redmond, Washington. Although e-mail firewall 105 is shown in Figure 1 as operating on e-mail messages between an internal site and an external site, the e-mail firewall 105 may also be used to exchange messages between two internal sites for computer networks with SMTP compliant messaging backbones.

Figure 2 of the drawings illustrates in block diagram form the major functional components of e-mail firewalls 105.1 and 105.2. In Figure 2, a Simple Mail Transfer Protocol (SMTP) relay module 202 performs the functions of a conventional Internet relay host. An example of an Internet relay host is the sendmail program. The SMTP relay module 202 transmits and receives e-mail messages such as shown at 204 to and from an internal site 210 and external sites 212. E-mail message 204 takes the form of a conventional e-mail message which contains a plurality of user specified information fields, such as source field 205 specifying an e-mail address for the source of the message 204, a destination field 206 specifying one or more destination e-mail address(es) for the message 204, a subject field 207 specifying a subject for the message 204, a body field 208 specifying the body of the message 204 containing textual and/or graphics data, and an attachment field 209 specifying one or more files to be transmitted with the message 204. Other user specified fields include, but are not limited to, priority of the message, identify of the sending agent and the date and time of the message.

E-mail message 204 may be encoded in accordance with one of a plurality of encoding formats as explained in further detail below. SMTP relay module 202 preferably takes a conventional form of a software module which receives and transmits e-mail messages in accordance with the Simple Mail Transfer Protocol as specified by Internet RFC 821. The SMTP protocol is not critical and in other embodiments, the SMTP relay module may be replaced with a module that receives and/or transmits messages in other formats such as the File Transfer Protocol (FTP) or the Hyper-Text Transfer Protocol (HTTP).

The SMTP relay module 202 can preferably be configured to use Domain Name System (DNS) to determine routing to message recipients or alternatively can relay messages to an administrator specified SMTP host. If DNS is selected, a default SMTP host can still be specified to allow a message to be forwarded even if DNS service is not available. The routing option can be overridden on a per-domain basis. The SMTP relay module 202 advantageously allows inbound and outbound SMTP connections to be limited from or to specific hosts and allows connections to or from specific SMTP hosts to be denied.

Figure 3 illustrates the manner in which messages received by the SMTP relay module 202 from internal site 210 and external sites 212 are processed by policy engine 214. Policy engine 214 accepts messages from SMTP relay module 202 and determines which policies are applicable to a message by building a list 302 of sender policies for the sender (source) 205 of the message, and building a list 304, 306 and 308 of recipient policies for each recipient. The policy engine 214 then calls the policy managers 216 to apply each policy. The different types of policies have a predetermined priority in which they are applied. For example, decryption policies are applied before other policies, to allow the policies that operate on the body 208 of the message to be able to access the contents contained therein. In an alternative embodiment, the order in which the policies are applied is selectable by a system administrator. Access manager policies get applied after decryption policies and then the other policy managers are called repeatedly and in the order implied by the policies to be applied to the message. The policy engine 214 then receives results from policy managers 216 and transmits messages to SMTP relay module 202 in accordance with the received results. The results received by the policy engine 214 comprise actions such as disposition, annotation and notification described in further detail herein. The result of processing of a message 204 by policy engine 214 can result in generation of a plurality of additional messages, for example, for notification to the sender or recipient, or to the system administrator. In a preferred embodiment, the policy engine 214 is implemented as a program executed by a digital computer.

Policy managers 216 operate to enforce policies entered by an administrator of e-mail firewall 105. Policy managers 216 preferably comprise a plurality of modules for enforcing administrator configured policies directed to specific aspects of e-mail messages. For example, in e-mail firewall 105, policy manager 216 implements a plurality of manager modules including an access manager 218, a content manager 220, a format manager 222, a virus manager 224 and a security manager 226. Policy managers 216 are preferably developed by inputs entered by an administrator by way of configuration module 230. Configuration module 230 also operates, in response to information entered by an administrator, to configure SMTP relay 202 and policy engine 214. The policy managers shown in Figure 2 and described herein are merely illustrative of an exemplary embodiment. Other types of policy managers are contemplated as being within the principals described herein.

Access manager 218 provides enforcement of access control policies such as destinations to which e-mail is prohibited from being sent, or sources from which e-mail cannot be received. Access manager 218 can also filter messages that exceed a maximum message size determined by an administrator, or which contain specific words in the subject field 207 of the message. Access manager 218 can also filter a message by the priority of the message specified by the user. For example, high priority messages can be passed through immediately while low priority messages are stored in a queue, explained in further detail in connection with Figure 7. Access manager 218 can also filter messages by the date and/or time of transmission of the message. For example, messages transmitted between certain hours of the day or on certain days, such as weekends or holidays may be retained or further filtered, by, for example, content manager 220.

Content manager 220 supports the enforcement of content control policies. Preferably content manager 214 supports filtering by one or more of the following criteria: (a) specific words in the body 208; (b) specific words in the subject 207 or body 208; (c) attachment 209 (all or by name/type). Content control policies, and other appropriate policies, can also be specified to require certain material, such as for example, certain notices or disclaimers. Virus manager 224 supports the enforcement of virus control policies by detecting virus infected e-mail attachments. Virus manager 224 preferably detects viruses contained in a plurality of compressed file formats including PKZip, PKLite, ARJ, LZExe, LHA, and MSCompress. Virus manager 224, by way of example, may use a commercially available virus scanning engine. Virus manager 224 also preferably applies policies on "clean messages," that is, messages that have been scanned for a virus and found to be free of any viruses. On such messages a "clean stamp" annotation is added to indicate that no viruses were detected.

Format manager 222 provides conversion of an e-mail message from a first format to a second format. In a preferred embodiment, format manager 222 converts messages from conventional UUENCODE format to MIME format. Preferably format manager 222 converts messages prior to message processing by other policy managers.

Security manager 226 preferably enforces a plurality of e-mail encryption policies. Preferably, security manager 226 enforces a client security usage policy, a preserve encryption policy, a plain text access policy, and default action policies. Security manager 226 also applies, on behalf of users, proxy encryption and signature policies, as discussed in further detail in connection with Figure 5(b).

Client security usage policies specify that certain users should perform encryption or signature at the desktop. Additional criteria can be set to indicate when this policy should be enforced. For example, an e-mail from a company's CEO to the company's legal counsel by the domain or full e-mail address can be specified to require encryption or signatures to enforce attorney-client privilege and to preserve encryption policies. Moreover, client security usage policies can be used to specify that messages that are already in encrypted form and perhaps meet some other criteria should be preserved, in other words, not processed or modified or encrypted by the e-mail firewall 105. Plain text access policies require that the e-mail firewall 105 be designated as a recipient on certain types of specified messages. The e-mail firewall 105 is designated as a recipient on encrypted messages in order to apply access, content, virus, and other policies on the message. Plain text access policies can also be used to send a signed notification to the sender of a message as a way of providing the sender with the e-mail firewall 105's public key. Default action policies indicate the action to be taken on messages that are not encrypted and will not be encrypted by the e-mail firewall 105 and which optionally meet some other criteria. This policy type is used to ensure that certain messages get encrypted somewhere, whether at the desktop or by the e-mail firewall 105.

Policies are preferably entered by an authorized administrator by way of configuration module 230 which preferably takes the form of a program executing on a stored program computer. Policies can advantageously be applied to users, either individually or by e-mail domains or other groupings. Figure 4 shows an example of how policies are applied. Users can be organized in a hierarchical directory-type structure to facilitate grouping of users and/or domains. If a policy is applied to a given directory then sub-directories corresponding to the given directory inherit such policies. For example, in Figure 4, policy 1 applies to sub-directory 404 and thus applies to all sub-directories, domains and users, such as sub-directory 412, user 408, and domain 410, corresponding to sub-directory 404, unless that policy is explicitly overridden by another policy applied to a particular sub-directory or to an intervening sub-directory. For example, policy 3 will override, for user 1 (shown at 408), policy 1 where there are conflicts between policy 1 and policy 3, and will supplement policy 1 where there are no conflicts. Exception 1 will override policies 1 and 3 for the particular exception specified in exception 1. As further shown in Figure 4, policy 1 applies to users 414, 416 and 418 and is overridden by policy 2 for users 414, 416 and 418 in the event of conflicts, and is supplemented where there are no conflicts. This advantageously allows policies to be easily applied to groups of users. The exact manner in which the policies are stored is not critical, however, and a variety of means and formats of storage may be employed.

E-mail messages 204 received and/or transmitted by SMTP relay 202 are preferably encoded in accordance with the S/MIME (Secure/Multipurpose Internet Mail Extension) protocol as specified by the Internet Engineering Task Force in documents entitled "S/MIME Message Specification" (1997) and "S/MIME Certificate Handling" (1997). Advantageously, the S/MIME protocol builds security on top of the industry standard MIME protocol according to Public Key Cryptography Standards (PKCS) specified by RSA Data Security, Inc. S/MIME advantageously offers security services for authentication using digital certificates, and privacy, using encryption. Digital certificates are preferably implemented in accordance with the X.509 format as specified in "Information Technology - Open Systems Interconnection - The Directory: Authentication Framework," also known as "ITU-T Recommendation X.509" (June 1997). Encryption is preferably performed by one of the following symmetric encryption algorithms: DES, Triple-DES, and RC2. The S/MIME protocol is well known and widely used and provides encryption and digital signatures and is therefore preferable as a communications protocol. The precise details by which the protocol operates is not critical. Moreover, it should be understood that other secure messaging protocols, such as PGP (Pretty Good Privacy) or Open PGP - as specified by the ITF working group may also be used.

Access manager 218 is the first policy manager to process e-mail message 204. Access manager 218 operates only on message header information which is not encrypted. Thus, access manager 218 may operate on an e-mail message 204 prior to decryption by S/MIME engine 215. The term "message header information" generally refers to portions of the message excluding the body 208 (also commonly referred to as message text) and attachments 209. Thus the header information includes the source, destination and subject fields (205,206,207). Other fields that may be included in the message header include date/time stamp, priority and sending agent. The remainder of the modules operate on the message 204 after processing by S/MIME engine 215. As previously noted, format manager 222 preferably operates on messages prior to operation by other managers such as virus manager 224, security manager 226 and content manager 220.

The S/MIME protocol allows two sites which support the S/MIME protocol to exchange secure e-mail messages 204. A type of virtual private network (VPN), as shown in Figure 5(a), can be achieved if both the transmitting and receiving site perform S/MIME functions. The resulting VPN, termed herein an "object level e-mail VPN," provides encryption/signature and/or decryption/verification of messages between transmitting and receiving site(s). In the object level e-mail VPN shown in Figure 5(a), each object (message) is encrypted individually and sent over a standard (SMTP) transport medium where each object (message) is decrypted at the other end. Advantageously, the object level e-mail VPN does not require a secure real-time connection as required by conventional VPNs. As shown in Figure 5(a), mail servers 105.1 and 105.2 perform functions described herein for e-mail firewall 105, and as a result, achieve an object level e-mail VPN between them. E-mail that is encrypted and transmitted between servers 105.1 and 105.2 is protected from disclosure to third parties, despite the fact that e-mail transmitted via the Internet 104 may pass through numerous unsecure servers before reaching its destination. In such an exchange, e-mail firewalls 105.1 and 105.2 provide key pair and public key certificate generation and provide automated or manual public key certificate exchange with the other S/MIME server. In addition, e-mail firewalls 105.1 and 105.2 allow: identification of the other S/MIME server through directory domain records, association of directory domain records with server certificates and selection of encryption/signature algorithms and key lengths. The directory domain records, and the directory user records referred to below, are as described in Figure 4.

Exchange of S/MIME encoded messages may also be performed between the e-mail firewalls 105.1 or 105.2 and an S/MIME client coupled to a server that does not perform S/MIME functions. Figure 5(b) illustrates an exchange between e-mail firewall

105 and a S/MIME client coupled to a non-S/MIME server 506. In Figure 5(b), server 105.1 encrypts and decrypts messages on behalf of client 502 and generally provides the functions described above for e-mail firewalls 105.1 and 105.2. Specifically, in such an exchange, e-mail firewall 105.1 provides key pair and public key certificate generation and provides automated or manual public key certificate exchange with the client 508.1. In addition, e-mail firewall 105.1 allows: identification of the client 508.1 through directory user records, association of directory user records with user certificates and selection of encryption/signature algorithms and key lengths. Client 508.1 provides encryption/decryption services to allow messages to be transmitted securely through server 506 by supporting encryption/decryption services. A specific type of object level VPN, referred to herein as "proxy security", is achieved in Figure 5(b) between the server 105.1 and the client 508.1. In proxy security, at least one client is involved in performing encryption/decryption, such as client 508.1 in Figure 5(b). This is in contrast to the arrangement of Figure 5(a), where the encryption/decryption services performed by servers 105.1 and 105.2 is transparent to the clients 502.1 and 502.2.

In Figure 5(a), communications between servers 105.1 and 105.2 are secure, but communications between clients 502.1 and 502.2 and their respective servers 105.1 and 105.2 are not secure. In many such installations, security is not necessary. However, if such security is desired, then the clients 508.1 and 508.2 can also be equipped with encryption/decryption services to perform proxy security. The servers 105.1 and 105.2 of Figure 5(c) perform the same function described above in connection with Figure 5(a) and therefore achieve an object level VPN. In addition, the clients 508.2 and 508.1 allow secure communications between corresponding servers 105.1 and 105.2. It should be noted that the encryption/decryption performed by servers 105.1 and 105.2 can be independent of the encryption performed by the corresponding clients 508.2 and 508.1. For example, a message by client 508.2 to client 508.1 may be encrypted when transmitted to server 105.1, decrypted by server 105.1 and subjected to appropriate actions by the policy managers, and then encrypted for transmission to server 105.2, decrypted by server 105.2 and subjected to appropriate actions by the policy managers, and then encrypted for transmission to client 508.1 which decrypts the message. Alternatively, a message by client 508.2 to client 508.1 may be encrypted by client 508.2, be subjected to appropriate actions to non-encrypted portions, such as the destination field, and then the entire message, including the portions not encrypted by client 508.2, can be encrypted again by server 105.1 for transmission to server 105.2, which decrypts the encryption by server 105.1, and transmits the message to client 508.1 for decryption of the encryption performed by client 508.2. A combination of the foregoing two scenarios is also possible.

Each e-mail message 204 processed by e-mail firewall 105 is processed in accordance with the steps shown in Figures 6(a) and 6(b). Figure 6(a) is a flowchart showing operation of the e-mail firewall 105 in response to a received message. Figure 6(b) is a flowchart showing operation of the e-mail firewall 105 prior to transmitting a message. The messages processed by e-mail firewall 105 may be received from an internal site for transmission to an internal site, or may be received from an internal sited for transmission to an external site, or may be received from an external site for transmission to an internal site. Any single message may include internal and external destinations 206. The steps shown in Figures 6(a) and 6(b) are performed by generation of sender and recipient policies shown in Figure 3. For multiple destinations, the steps shown in Figure 6(b) may therefore be performed differently and have different results for different destinations.

Turning to Figure 6(a), at 602, the e-mail firewall 105 determines if decryption of portions of the message 204 is required. If so, then at 604, decryption is performed in accordance with stored keys 628. After decryption, or if no decryption is required, then the e-mail firewall 105 applies policy managers 216, which perform four types of actions (shown at 610, 612, 614, 616 and 620) on e-mail message 204. Criteria actions 610 present filtering criteria selected by the administrator. Exception actions 612 determine which criteria 610 are excluded. Multiple criteria 610 can be selected which effectively results in a logical AND operation of the criteria. Multiple exceptions 612 can be selected which effectively results in a logical OR operation of the exceptions; that is, any one of the exception conditions being true will result in a policy not being triggered. Annotation actions 614 cause generation of an attachment to message 602 or insertion of text into the body 208 of the message. The manner in which annotations are made is based on a policy entered by the administrator. Notification actions 616 cause the sending of one or more e-mail notifications when a given policy is triggered. Notifications can be sent to sender, recipient, administrator, or any e-mail address that is defined by the administrator. In addition, notification actions 616 allow specification of whether the original message 204 should accompany the notification. Disposition action 620 determines whether the message should continue to the destination(s) (specified by field 206) or whether one of a plurality of alternative actions 622 such as deferral, quarantine, return to sender, or dropping of the message are required.

The steps shown in Figure 6(b) are performed for each destination specified for a message 204. The steps shown in Figure 6(b) are also performed for messages generated by step 622. First, policy managers 216 perform actions 610, 612, 614 and 616, for each destination specified in the message 204. Disposition action 623, operates similarly to disposition action 620 by determining whether the message should continue to the destination(s) (specified by field 206) or whether one of a plurality of alternative actions 622 such as deferral, quarantine, return to sender, dropping of the message, or deferral are required. At step 624, a determination is made if encryption of the message is required. If so, then at step 626 encryption is performed in accordance with stored keys 628. If not, then the message is transmitted to the specified destination at step 630. Messages that are processed by block 622 are also checked at step 624 before transmission. For example, messages that are deferred, quarantined or returned to the sender may need to be encrypted.

Figure 7 is a block diagram showing further details of alternative actions 622. Messages received from disposition step 620 are stored in one of the four queues 702, which include quarantine queue 704, retry queue 706, dead letter queue 708, and defer queue 709 depending upon the specified disposition of the message. Quarantine queue 704 stores messages for subsequent retrieval and review by a system administrator or other authorized person. Retry queue 706 stores messages for which delivery has failed. Transmission of messages in the retry queue 706 is subsequently re-attempted. Dead letter queue 708 stores messages which continue to be undeliverable after several retries and which cannot be returned to the sender. Messages in the dead letter queue 708 may be acted upon by a system administrator. Defer queue 709 stores messages to be delivered automatically at a later time, for example an off-peak-time such as a weekend or night time. Configuration module 230 provides a plurality of actions 710-714 which may be performed on the messages in queue 702. The messages can be viewed 710 by the administrator, returned to the sender 711, deleted 712, sent to the specified destination(s) 713 and/or saved 714.

It is to be understood that the specific mechanisms and techniques which have been described are merely illustrative of one application of the principals of the invention. Numerous modifications may be made to the methods and apparatus described without departing from the true spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. An e-mail control system for controlling e-mail messages transmitted from and received by a computing site, comprising:

a message encryptor for encrypting a first designated type of message transmitted from said computing site in accordance with at least a first stored encryption key;

a message decryptor for decrypting a second designated type of message received by said computing site in accordance with at least a second stored encryption key; and

a filter for monitoring messages, after decryption by said decryptor and before encryption by said encryptor, in accordance with changeable filter information.

2. An e-mail control system as set forth in claim 1 wherein said filter comprises a content filter for restricting transit of said messages which contain information corresponding to changeable content filter information.

3. An e-mail control system as set forth in claim 2 wherein each of said messages comprise destination information, identifying at least a first destination for said message, and wherein said filter further comprises a destination filter for restricting transit of said messages which contain information corresponding to changeable destination filter information.

4. An e-mail control system as set forth in claim 3 wherein each of said messages comprise source information, identifying at least a first source for said message, and wherein said filter further comprises a source filter for restricting transit of said messages which contain information corresponding to changeable source filter information.

5. An e-mail control system as set forth in claim 4 further comprising means, responsive to said filter, for causing redirection of messages which contain information corresponding to said changeable filter information to a destination which differs from at least said first destination of said message.

6. An e-mail control system as set forth in claim 5 further comprising means, responsive to said filter, for causing redirection of messages which contain information corresponding to said changeable filter information to a destination which corresponds

to at least said first destination of said message.

7. An e-mail control system as set forth in claim 6 further comprising:

notification means, responsive to said means for causing redirection of messages, for causing generation of a notification e-mail message; and

redirection means for causing transmission of said notification e-mail message to a destination corresponding to changeable notification message destination information.

8. An e-mail control system as set forth in claim 7 wherein said notification message comprises a body portion and wherein said notification means further comprises means for causing generation of a message contained in said body portion.

9. An e-mail firewall, for processing e-mail messages transmitted between an internal site and a plurality of external sites, comprising:

an e-mail relay for accepting an unscreened encrypted e-mail message from a first external site and for transferring a screened encrypted e-mail message to a second external site;

a security manager responsive to said unscreened encrypted e-mail message received from said first external site for decrypting said message to generate, in accordance with a first stored key, an unscreened unencrypted message and responsive to a screened unencrypted e-mail message for encrypting, in accordance with a second stored key, said screened unencrypted e-mail message to generate said screened encrypted e-mail message; and

a policy manager responsive to said unscreened unencrypted e-mail message generated by said security manager for screening said unscreened unencrypted e-mail message in accordance with stored policy information to generate a screened unencrypted e-mail message for a first internal site designated by said screened unencrypted e-mail message and responsive to an unscreened, unencrypted e-mail message from a second internal site for screening said unscreened, unencrypted e-mail message in accordance with said stored policy information to generate said screened unencrypted e-mail message for said security manager.

10. An e-mail firewall for restricting transmission of e-mail messages between a first site and a plurality of second sites in accordance with a plurality of administrator

selectable policies, said firewall comprising:

a simple mail transfer protocol (SMTP) relay for causing said e-mail messages to be transmitted between said first site and selected ones of said second sites; and

a plurality of policy managers, responsive to said SMTP relay, for enforcing administrator selectable policies, said policies comprising at least a first source/destination policy, at least a first content policy and at least a first virus policy, said policies characterized by a plurality of administrator selectable criteria, a plurality of administrator selectable exceptions to said criteria and a plurality of administrator selectable actions associated with said criteria and exceptions, said policy managers comprising,

an access manager for restricting transmission of e-mail messages between said first site and said second sites in accordance with said source/destination policy;

a content manager for restricting transmission of e-mail messages between said first site and said second sites in accordance with said content policy; and

a virus manager for restriction transmission of e-mail messages between said first site and said second sites in accordance with said virus policy.

11. An e-mail firewall as set forth in claim 10 wherein said policy managers further comprise a format manager, responsive to said administrator selectable policies, for converting said e-mail messages from a first format to a second format.

12. An e-mail firewall as set forth in claim 10 wherein said e-mail messages are formatted into a plurality of fields comprising a source field, a destination field, subject field, and a message field and wherein said access manager is responsive to said source/destination policy specified for each of said fields of said e-mail messages.

13. An e-mail firewall as set forth in claim 12 wherein said e-mail messages are further characterized by a size field and wherein said access manager is responsive to said source/destination policy specified for said size field.

14. An e-mail firewall as set forth in claim 12 wherein said e-mail messages are further characterized by a date and time field and wherein said access manager is responsive to said source/destination policy specified for said date and time field.

15. An e-mail firewall as set forth in claim 10 wherein said virus manager is

responsive to e-mail messages containing compressed information for detecting viruses contained in said compressed information.

16. An e-mail firewall as set forth in claim 12 wherein said content manager is responsive, in accordance with said content policy, to information contained in said subject field and in said message field.

17. An e-mail firewall as set forth in claim 16 wherein said e-mail message further comprises an attachment field and wherein said content manager is responsive, in accordance with said content policy, to an attachment designated in said attachment field.

18. A method for restricting transmission and receipt of e-mail messages, in accordance with a plurality of changeable policies, between a first site and a plurality of second sites, the method comprising the steps of:

intercepting a first e-mail message transmitted between said first site and at least one of said second sites;

determining if said message is encrypted and decrypting said message in accordance with a stored key, if said message is encrypted; and

filtering said message in accordance with a plurality of stored policies.

19. A method as set forth in claim 18 further comprising the steps of:

intercepting a second e-mail message transmitted between one of said second sites and said first site;

filtering said message in accordance with said plurality of stored policies;

responding to a first of said stored policies by encrypting said message in accordance with said stored key; and

transmitting said message to said first site.

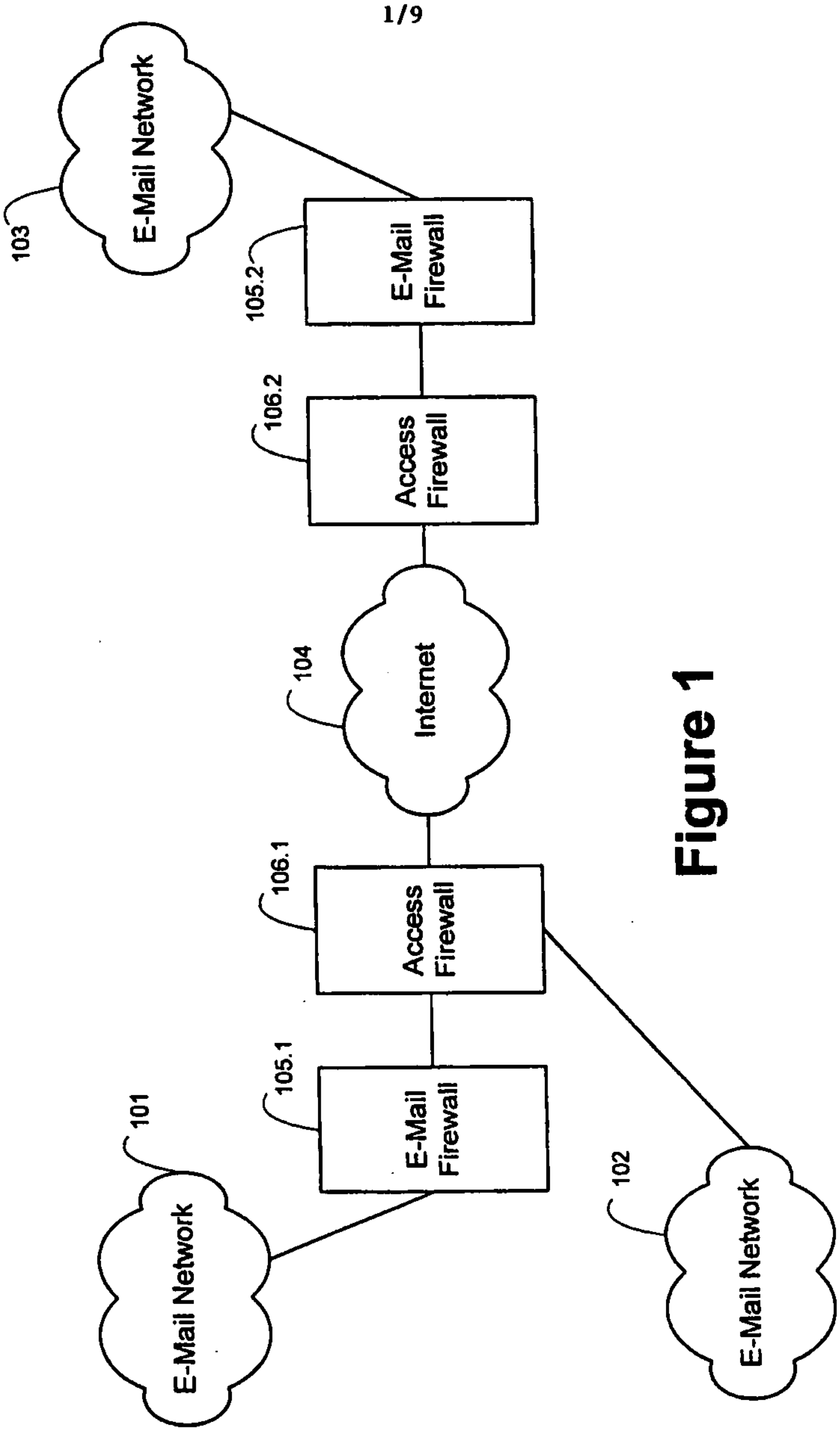
E-Mail Network
103
E-Mail Firewall
105.2
Access Firewall
106.2
Internet
104
Access Firewall
106.1
E-Mail Firewall
105.1
101
E-Mail Network
102
E-Mail Network

Figure 1

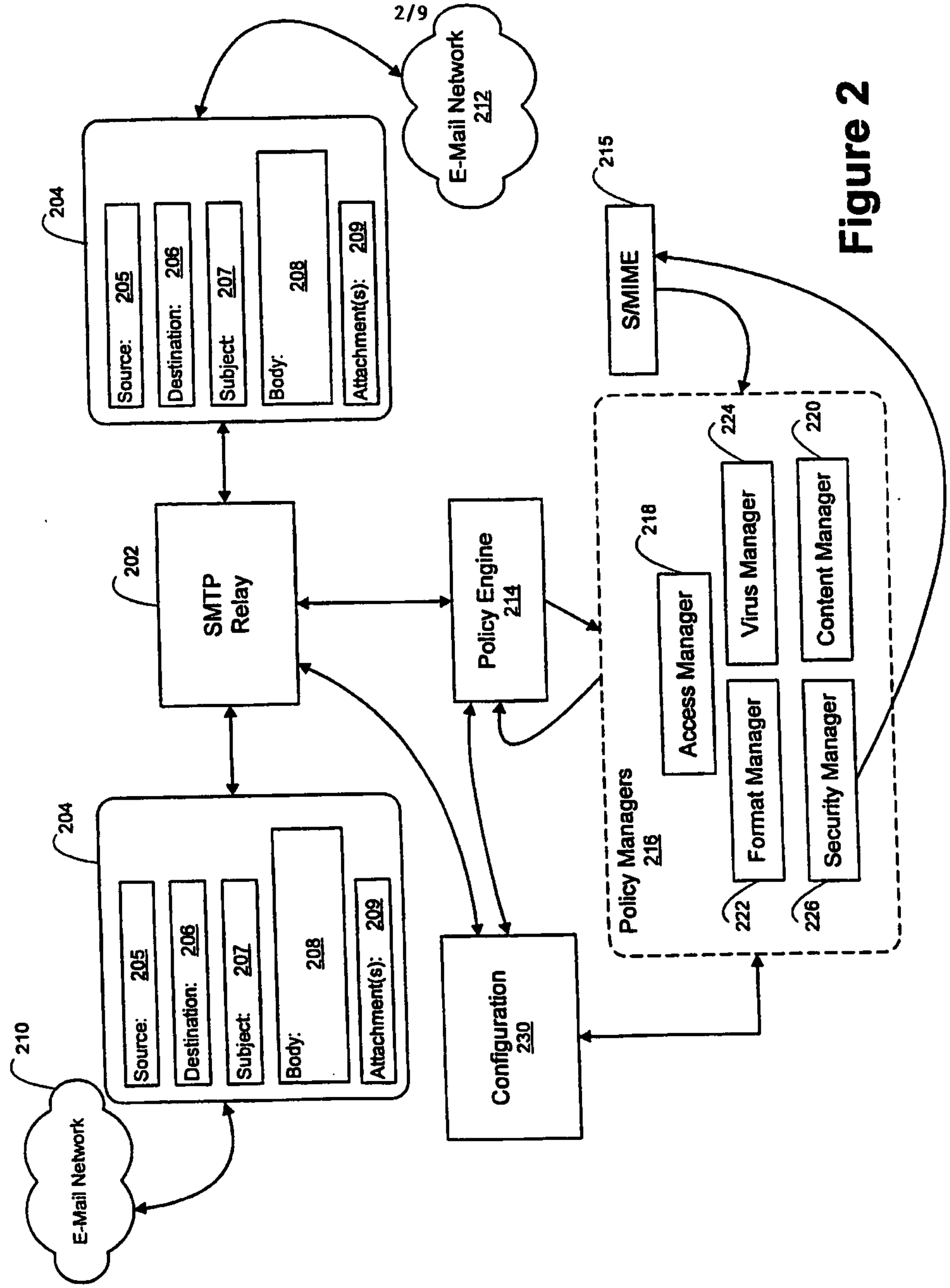
E-Mail Network
212
204
Source:
205
Destination:
206
Subject:
207
Body:
208
Attachment(s):
209
202
SMTP
Relay
Policy Engine
214
215
S/MIME
224
Virus Manager
220
Content Manager
218
Access Manager
Format Manager
Security Manager
Policy Managers
216
222
226
204
Source:
205
Destination:
206
Subject:
207
Body:
208
Attachment(s):
209
210
E-Mail Network
Configuration
230

Figure 2

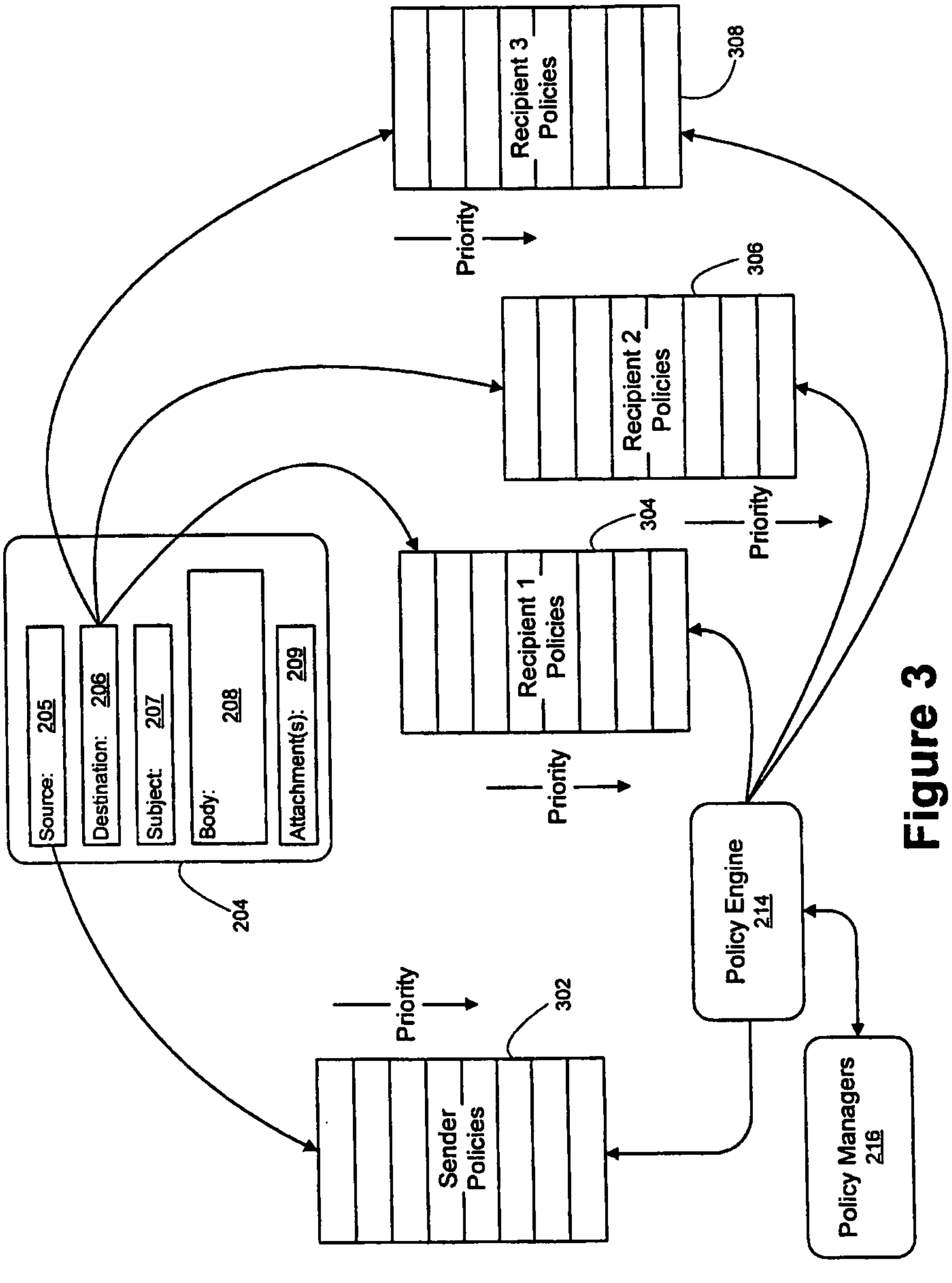
Source: 205
Destination: 206
Subject: 207
Body: 208
Attachment(s): 209
204
Sender Policies
302
Priority
Recipient 1 Policies
304
Priority
Recipient 2 Policies
306
Priority
Recipient 3 Policies
308
Priority
Policy Engine 214
Policy Managers 216

Figure 3

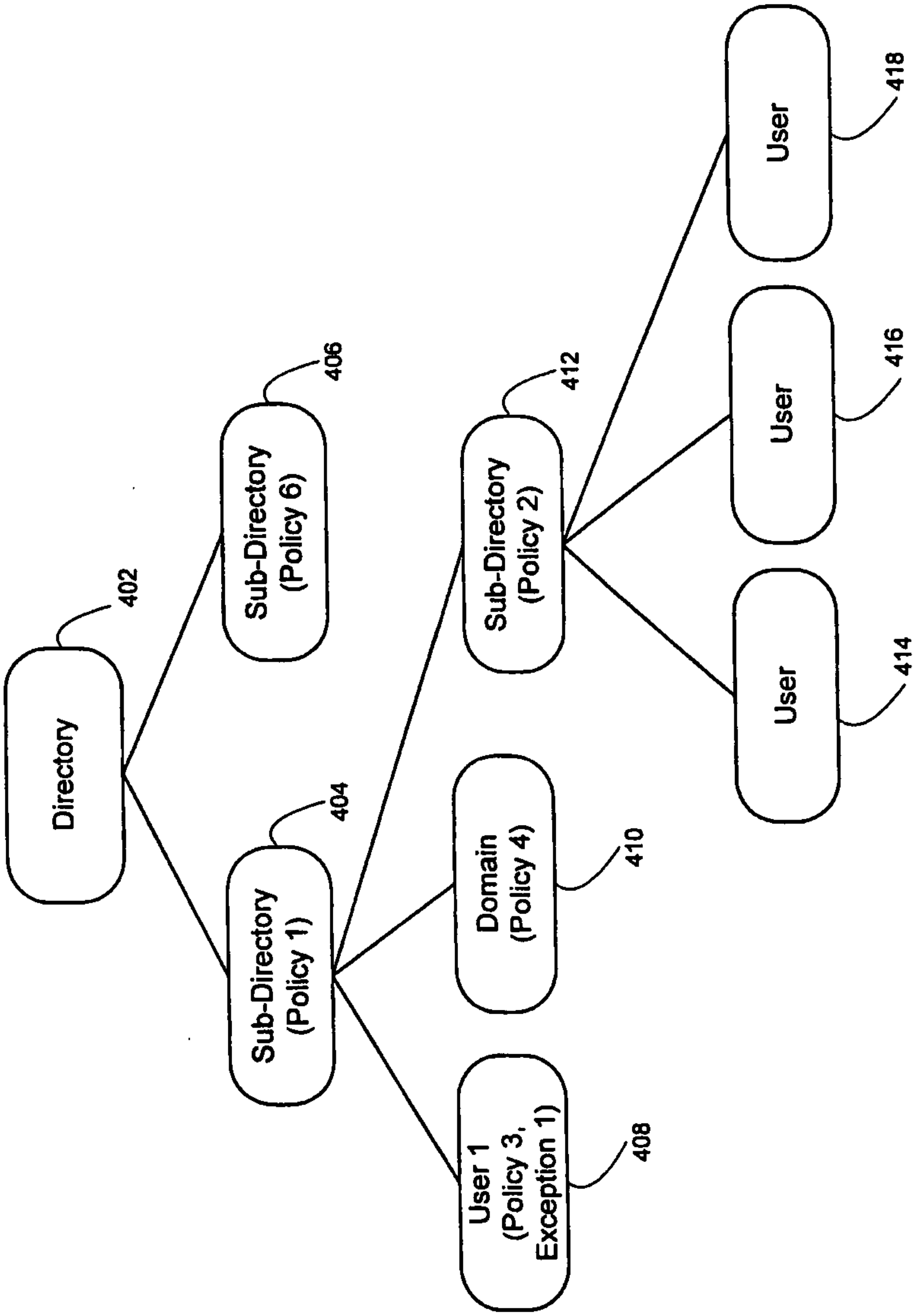
Directory
402
Sub-Directory (Policy 6)
406
Sub-Directory (Policy 1)
404
User 1 (Policy 3, Exception 1)
408
Domain (Policy 4)
410
Sub-Directory (Policy 2)
412
User
414
User
416
User
418

Figure 4

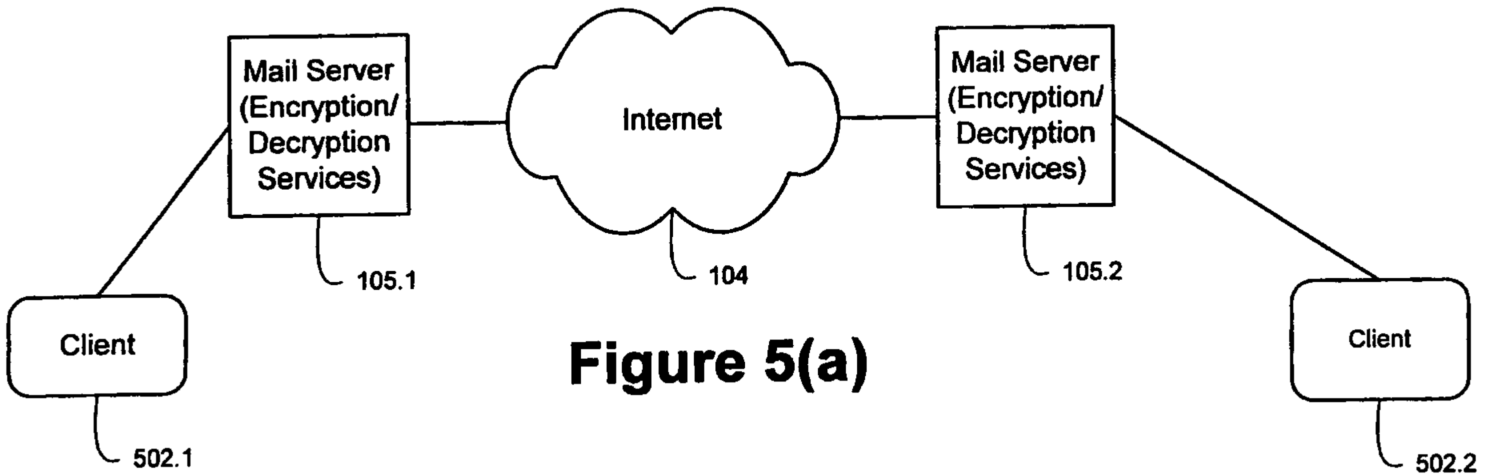
Client
502.1
Mail Server (Encryption/ Decryption Services)
105.1
Internet
104
Mail Server (Encryption/ Decryption Services)
105.2
Client
502.2

Figure 5(a)

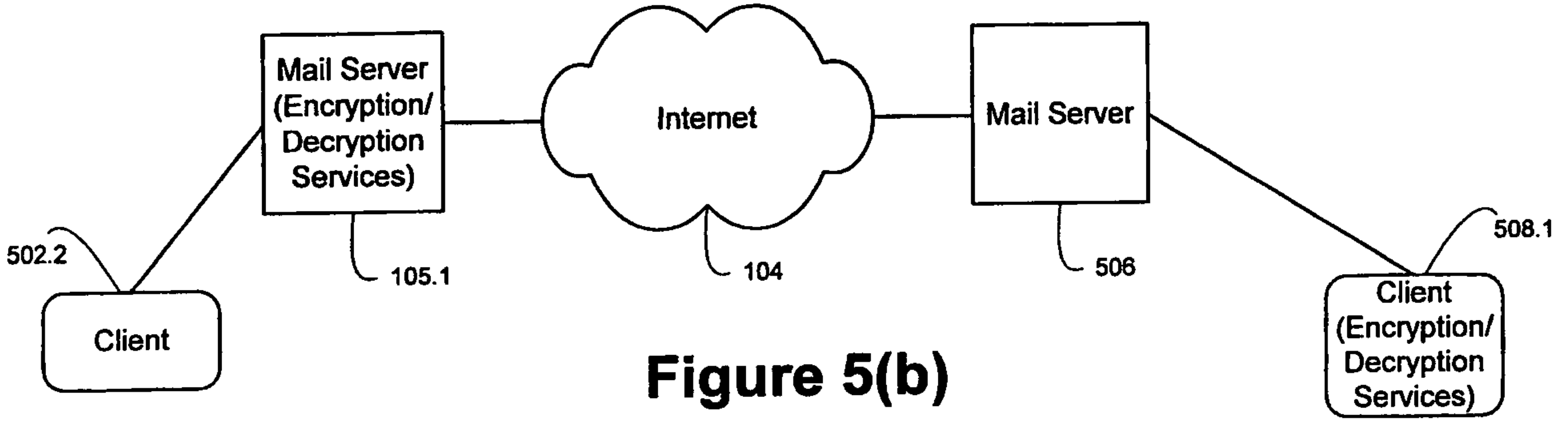
502.2
Client
Mail Server (Encryption/ Decryption Services)
105.1
Internet
104
Mail Server
506
508.1
Client (Encryption/ Decryption Services)

Figure 5(b)

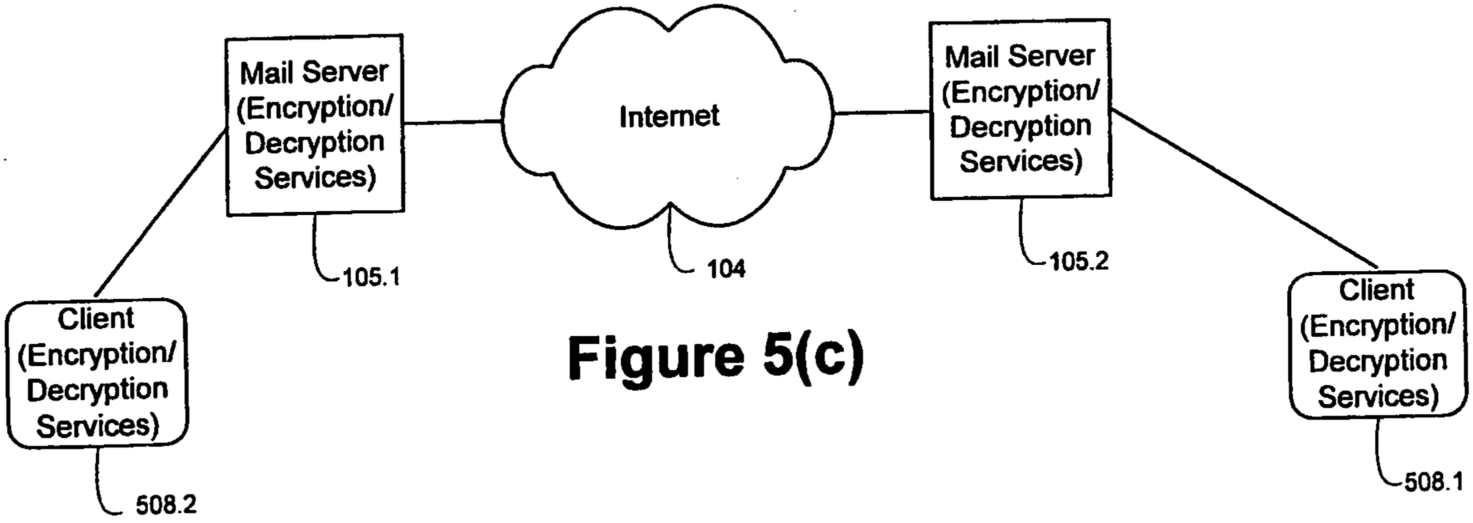
Client
(Encryption/
Decryption
Services)
508.2
Mail Server
(Encryption/
Decryption
Services)
105.1
Internet
104
Mail Server
(Encryption/
Decryption
Services)
105.2
Client
(Encryption/
Decryption
Services)
508.1

Figure 5(c)

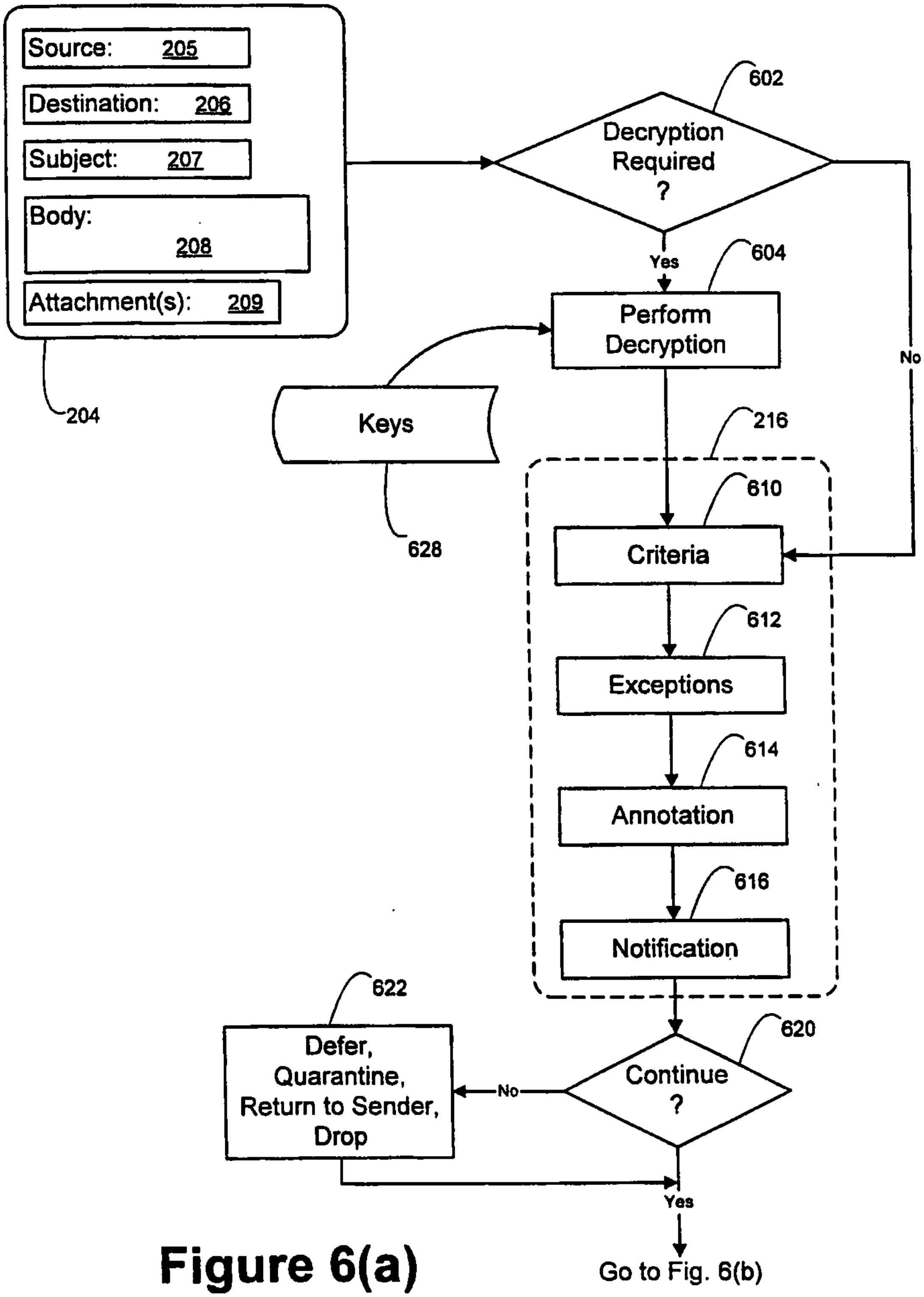
Source: 205
Destination: 206
Subject: 207
Body: 208
Attachment(s): 209
204
602
Decryption Required ?
Yes
No
604
Perform Decryption
Keys
628
216
610
Criteria
612
Exceptions
614
Annotation
616
Notification
622
Defer, Quarantine, Return to Sender, Drop
No
620
Continue ?
Yes
Go to Fig. 6(b)

Figure 6(a)

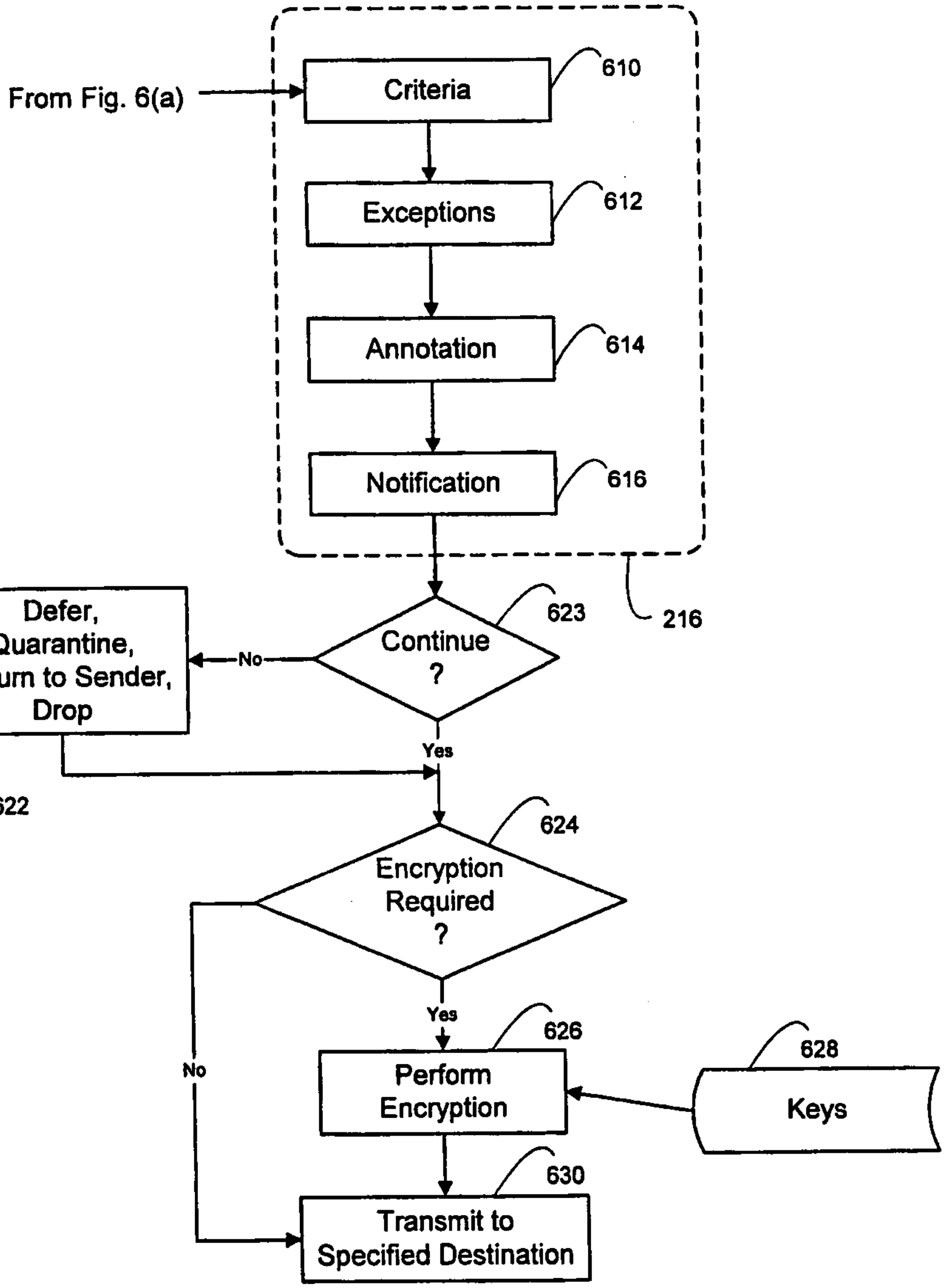
From Fig. 6(a)
Criteria
610
Exceptions
612
Annotation
614
Notification
616
216
Continue ?
623
No
Defer, Quarantine, Return to Sender, Drop
622
Yes
Encryption Required ?
624
Yes
No
Perform Encryption
626
Keys
628
Transmit to Specified Destination
630

Figure 6(b)

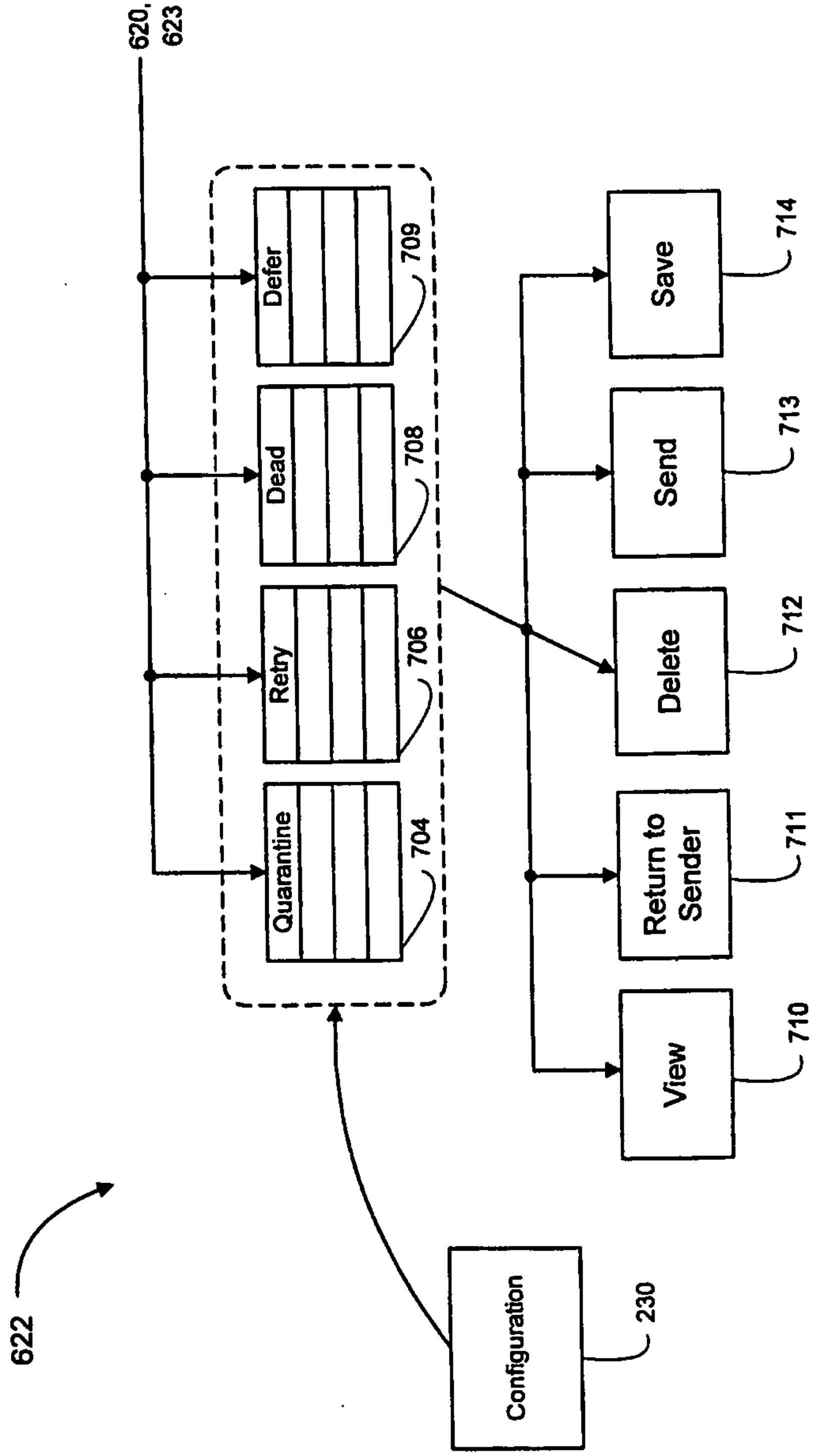
620,
623
Defer
709
Dead
708
Retry
706
Quarantine
704
Save
714
Send
713
Delete
712
Return to Sender
711
View
710
Configuration
230
622

Figure 7